Clinical approach & management of fractures

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treat the patient, not only the fracture.

General resuscitation is the first consideration

But

there should be no undue delay in attending to the fracture.
To manage Fractures

Whether it is open or closed remember

Reduce  To restore proper alignment to fracture

Hold  Restriction of movement

Exercise
Closed fractures

is a broken bone that does not penetrate the skin.

Remember to manage closed fractures

Resuscitation - Reduction - Hold - Exercise
Reduce

Reduction should aim for adequate apposition and normal alignment of the bone fragments. The greater the contact surface area between fragments the more likely is healing to occur when we consider reduction unnecessary?

(1) when there is little or no displacement
(2) when displacement does not initially matter (e.g. in some fractures of the clavicle); and
(3) when reduction is unlikely to succeed (e.g. with compression fractures of the vertebrae).
Reduction

Closed reduction

Open Reduction

Manipulation

Mechanical

manual
Closed reduction

Used in case of:
- minimally displaced fractures
- fractures in children (most of it)
- fractures that are likely to be stable after reduction.
- Unstable fractures are sometimes reduced ‘closed’ prior to mechanical fixation.
Manipulation
**Mechanical**

Used with the fractures are difficult to reduce by manipulation because of counterforces exerted by powerful muscles. (e.g. of the femoral shaft)

It also serves to hold the fracture until it starts to unite.

This method was widely employed in the past but with modern technical improvements it has fallen out of favour.
Open reduction

Operative reduction under direct vision is indicated:
(1) when closed reduction fails, either because of difficulty in holding the fragments together or because soft tissues are interposed between them

(2) when there is a large articular fragment that needs accurate positioning

(3) for avulsion fractures in which the fragments are held apart by muscle pull
(4) when an operation is needed for associated injuries (e.g. arterial damage).

Generally open reduction is the first step to internal fixation.
Hold

**Effects:**
- prevention of displacement.
- Some restriction of movement is also needed to alleviate pain.
- to promote soft-tissue healing and to allow free movement of the unaffected parts.
There is a problem in how to hold a fracture adequately and yet use the limb sufficiently.
This is a conflict (Hold v. Move) which the surgeon seeks to resolve as rapidly as possible (e.g. by internal fixation), but without incurring unnecessary risks.
So here is a second conflict (Speed v. Safety). This dual conflict encapsulates four important factors that influence the modern approach to fracture management.
Closed methods are most suitable for fractures with intact soft tissues.

(For closed methods, the muscles surrounding a fracture act as a fluid compartment; traction or compression creates a hydraulic effect that is capable of splinting the fracture.)

Contraindications of closed methods:
- Fractures with severe soft-tissue damage
- Inherently unstable fractures,
- Multiple fractures
- Fractures in confused or unco-operative patients
Sustained traction

Traction is applied to the limb distal to the fracture, so as to exert a continuous pull in the long axis of the bone.

In most cases a counterforce will be needed to prevent the patient simply being dragged along the bed.

-The method is particularly useful for spiral fractures of long-bone shafts, which are easily displaced by muscle contraction.

The hold is obviously not perfect, but traction is safe.

The problem is speed (or rather lack of it): not because the fracture unites slowly (it does not) but because sustained lower limb traction keeps the patient in bed for a long time, thus increasing the likelihood of complications such as thromboembolism, respiratory problems and general weakness.
For this reason sustained traction is best avoided in elderly patients, and even in younger patients traction should be replaced by cast splintage or functional bracing as soon as the fracture becomes ‘sticky’ (deformable but not displaceable).

Note:
sustained traction does carry certain risks. In children especially, traction tapes and circular bandages may constrict the circulation; for this reason ‘gallows traction’, in which the baby’s legs are suspended from an overhead beam, should never be used for children over 12 kg in weight.

In older people, leg traction may predispose to peroneal nerve injury and cause a drop-foot; the limb should be checked repeatedly to see that it does not roll into external rotation during traction.

If skeletal traction is used, the pin sites must at all times be kept clean and checked for infection.
Sustained traction

- Traction by gravity
- Skin traction
- Skeletal traction

is suitable only for upper limb injuries.
Skin traction

- fixed
- Balanced
- combined

In combined traction the tapes are tied to the end of the splint and the entire splint is then suspended, as in balanced traction.

THOMAS SPLINT

will sustain a pull of no more than 4 or 5 kg.
A stiff wire or pin is inserted – usually behind the tibial tubercle for hip, thigh and knee injuries, or through the calcaneum for tibial fractures – and cords are attached to them for applying traction.
Cast splintage

It is safe enough, so long as one is alert to the danger of a tight cast and provided pressure sores are prevented.

The speed of union is neither greater nor less than with traction, but the patient can go home sooner. Joints encased in plaster cannot move and are liable to stiffen; this can be minimized by:

(a) delayed splintage
– by using traction until movement has been regained, and only then applying plaster
(b) using the cast till the limb can be handled without too much discomfort and then replacing it with a functional brace which permits joint movement.
Complications Tight cast:

- the cast may be put on too tightly, or it may become tight if the limb swells. The patient complains of diffuse pain; only later do the signs of vascular compression appear. The limb should be elevated, but if the pain does not subside during the next hour the only safe course is to split the cast, ease it open throughout its length and cut through all the padding down to skin. Whenever swelling is anticipated the cast should be applied over thick padding and then split before it sets, so as to provide a firm but not absolutely rigid splint.

Pressure sores – even a well-fitting cast may press upon the skin over a bony prominence. The patient complains of localized pain precisely over the pressure spot. Such localized pain demands immediate inspection through a window in the cast.

Skin abrasion or laceration – this is really a complication of removing the cast, especially if an electric saw is used. Complaints of nipping or pinching during plaster removal should never be ignored.

Loose cast – once the swelling has subsided, the cast may no longer hold the fracture securely. If it is loose the cast should be replaced.
Functional bracing

Segments of a cast are applied only over the shafts of the bones, leaving the joints free; cast segments above and below a joint can be connected by metal or plastic hinges which allow movements in one plane.

-is one way of preventing joint stiffness because joint movements are less restricted than with conventional casts while still permitting fracture splintage and loading.
since the brace is not very rigid, it is usually applied only when the fracture is beginning to unite, i.e. after 3–6 weeks of traction or restrictive splintage.

Used in this way, this method comes out well on all of the basic requirements:
- the fracture can be held reasonably well
- the joints can be moved the fracture joins at normal speed without keeping the patient in hospital
- the method is safe.
Internal fixation

is a surgical procedure used to internally set and stabilize fractured bones.

Types of internal fixation

Screws – interfragmentary screws (lag screws) are useful for fixing small fragments onto the main bone.

Wires – stiff, K- wires (often inserted percutaneously without exposing the fracture) can hold fracture fragments together. They are used in situations where fracture healing is predictably quick; some form of external splintage (usually a cast) is applied as supplementary support.
Plates and screws – this form of fixation is useful for treating both tubular and flat bones. Plates can also be shaped;

Intramedullary nails – these are suitable for long bones. A nail (or long rod) is inserted into the medullary canal to splint the fracture; rotational forces are resisted by introducing locking screws which transfix the bone cortices and the nail proximal and distal to the fracture. Nails can be used with or without prior reaming of the medullary canal; reaming achieves an interference fit which further improves fracture stability, though at the expense of some damage to the intramedullary blood supply.
Indications for internal fixation
■ Fractures that cannot be reduced except by operation
■ Fractures that are inherently unstable and prone to re-displacement after reduction (e.g. midshaft fractures of the forearm and some ankle fractures).
■ Fractures that unite poorly and slowly, principally fractures of the femoral neck.
■ Pathological fractures, in which bone disease may prevent healing.
■ Multiple fractures, where early fixation reduces the risk of general complications.
■ Fractures in patients who present severe nursing difficulties.

More controversial is the use of internal fixation as a preferred, rather than a necessary, form of treatment. The introduction of reliable image-guided techniques for ‘closed’ reduction and nailing of long-bone fractures has gained wide acceptance as an alternative to more difficult and cumbersome non-operative methods.
movements can begin at once; with early movement the ‘fracture disease’ (stiffness and oedema) is abolished. Speed is not an issue; the patient can leave hospital as soon as the wound is healed, but even though the bone moves in one piece, the fracture is not united – it is merely held by a metal bridge and unprotected weightbearing is, for some time, unsafe.

The greatest danger, however, is sepsis
Complications of internal fixation

Most of the complications of internal fixation are due to poor technique, poor equipment or poor operating conditions.

- Infection:
The risk of infection depends upon:
(1) the patient – devitalized tissues, a dirty wound and an unfit patient are all dangerous
(2) the surgeon – thorough training, a high degree of surgical dexterity and adequate assistance are all essential
(3) the facilities – a guaranteed aseptic routine, a full range of implants and staff familiar with their use are all indispensable
*the metal does not predispose to infection

If the infection is not rapidly controlled by intravenous antibiotic treatment, all the manifest advantages of internal fixation (precise reduction, immediate stability and early movement) may be lost.

the implants should be replaced with some form of external fixation.
-Non-union: causes of non-union are excessive stripping of the soft tissues, unnecessary damage to the blood supply in the course of operative fixation and rigid fixation with a gap between the fragments.

-Implant failure: metal is subject to fatigue, and undue stresses should therefore be avoided until the fracture has united. Patients with femoral or tibial fractures should still use crutches until there are signs of fracture healing (6 weeks at least). Pain at the fracture site is a danger signal!

-Re-fracture: it is important not to remove metal implants too soon, or the bone may re-fracture; a year is the minimum and 18 or 24 months safer. For several weeks after implant removal the bone is weak, so full weightbearing should be avoided.
External fixation

bone is transfixed above and below the fracture with screws or pins or tensioned wires and these are then clamped to a frame, or connected to each other by rigid bars.

Indications

■ Fractures associated with severe soft-tissue damage where internal fixation is risky, or to allow the wound to be left open for inspection, dressing or definitive coverage
■ Severely comminuted and unstable fractures, which can be held out to length while healing.
■ Patients with multiple severe fractures.
■ Fractures of the pelvis, which often cannot be controlled quickly by any other method.
■ Fractures associated with major vessel damage.
■ Infected fractures, for which internal fixation might not be suitable.
■ Ununited fractures which require bone reconstruction.
Complications of external fixation
- Damage to soft-tissue structures by transfixing pins or wires.
- Nerves or vessels may be inadvertently injured, or ligaments may be tethered.
- Over-distraction may prevent contact between the fragments, making union unlikely.
- Pin-track infection is unlikely with good operative technique; nevertheless, meticulous pin-site care is essential, and antibiotics should be administered immediately if infection occurs.
Exercise
‘restore function’ – not only to the injured parts but also to the patient as a whole.

- reduce edema
  may cause tissue tension and blistering.
  It is also an important cause of joint stiffness, especially in the hand treated energetically by a combination of elevation and active exercises.
  **elevate and exercise; never dangle, never force.**

- preserve joint movement
- restore muscle power
- guide the patient back to normal activity.
- stimulates the circulation
- prevents soft-tissue adhesion
- promotes fracture healing
active exercises involve your physical effort exerted into muscular activity. These exercises can include active range of motion, like self-stretching, As long as you’re doing the exercises yourself, it’s active exercise.

Passive exercises are also known as passive range of motion (ROM) exercises; and your range of motion includes how far you can move your joints in different directions. These exercises are considered passive because you don’t exert any effort. Instead, someone helps you move your muscles and joints through their full range of motion for you.

It has long been taught that passive movement can be deleterious, especially with injuries around the elbow where there is a high risk of developing myositis ossificans. Certainly forced movements should never be permitted, but gentle assistance during active exercises helps to retain function or regain movement after fractures involving the articular surfaces. Nowadays this is done with machines that can be set to provide a specified range and rate of movement (continuous passive motion).